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NATIONAL GEOGRAPHIC

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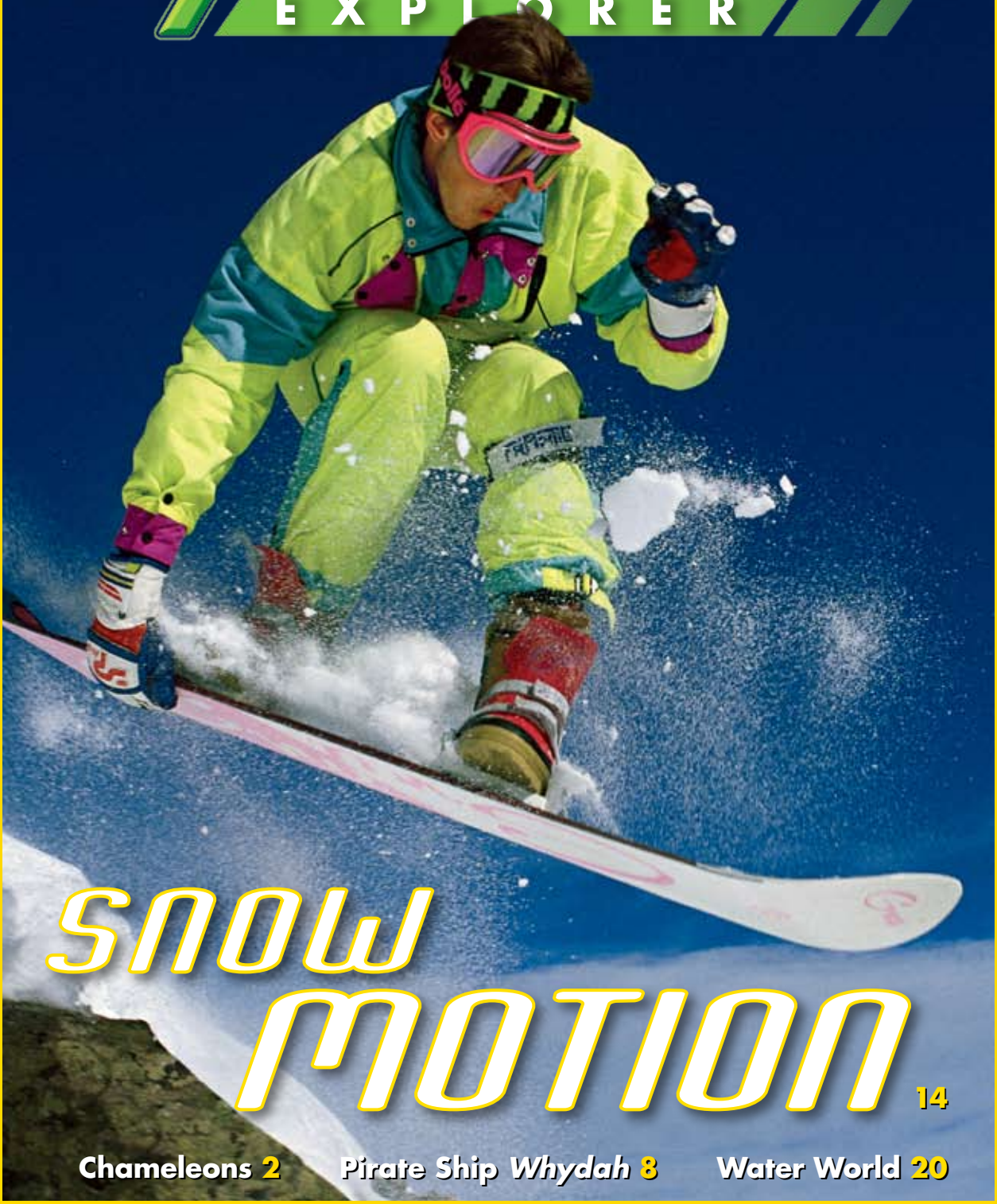


SNOW MOTION 14

By Sharon Katz Cooper

Chameleons

Meet an amazing animal that changes the color of its skin.

Reading Strategy: As you read, use self–stick notes to write down any questions you have. Then try to find the answers.

LIFE SCIENCE

Chameleons like to live in trees and bushes.

Chameleons are colorful lizards. Some live in rain forests. Others like the desert. They are found on the island of Madagascar, in Africa, India, and the Middle East. They live in different habitats—and look different from one minute to the next.

Colorful Cells

Around the world, there are more than 100 **species** of chameleons. All of them change color. Some can change how they look in just 20 seconds. Most turn into dull shades of color, called Earth tones. They change from brown to green, and back to brown again. Yet some, like the one you see on the next page, can turn into wild colors.

What causes the switch? The lizard's skin **cells** do. Cells are tiny building blocks that make up the bodies of living things. Cells in the top layer of the lizard's skin are **transparent,** or clear. Under that top layer lie cells with color, or **pigment.**

The cells with color grow in layers under the transparent top. As you see in the diagram (next page), cells in the upper layers of color have red or yellow pigment. Those in lower layers have blue or white.

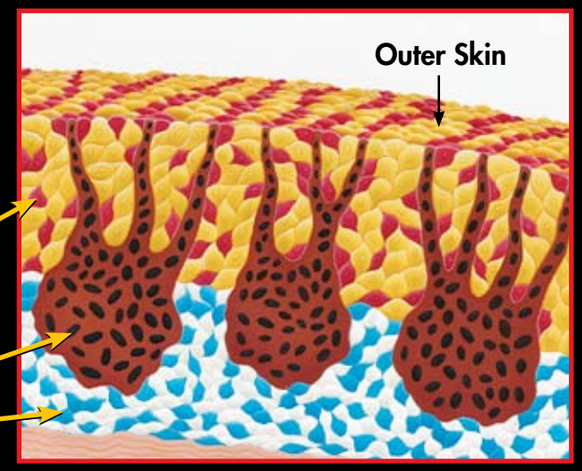
A chameleon's skin cells can change size on cue. Sometimes they are small. At other times, they grow larger. The larger the cell, the more color shows. So the color of the largest cells gives the chameleon its color.

A chemical called **melanin** also changes a chameleon's look. It spreads through the skin and darkens it.

on cue: when told to

Under the Skin

With each color change, a chameleon's color cells change size. Some become smaller, and others get larger. Often a chemical called melanin rises from lower to upper layers of skin. It makes the skin look darker.



STEPHEN R. WAGNER

When a panther chameleon is angry, its skin changes from green to red and yellow.

BRIAN KENNEY

The bright colors of a female carpet chameleon (at right) tell a male (at left) to go away.

Chromatic Chameleons

You may wonder why chameleons change color. Many people think it's to help the lizards hide. Yet the crazy colors turn up for other reasons. Bright light causes a color change, as does dim light. Higher and lower heat also cause changes. Even a mood shift brings about a change.

How does that work? Imagine a dark brown chameleon that is resting in the sun. It gets hotter and hotter. Finally, it is too hot. Most animals have to go into the shade to cool down. Not the chameleon.

The chameleon's cells get busy. They change size so that the yellow ones become bigger than the others. The yellow cells combine with blue cells, turning the chameleon green. Green skin helps the lizard stay cool. More of the sun's rays bounce off the color green.

If the chameleon gets too cool, it changes color again. The lizard becomes darker. Its new color takes in more sun rays. The chameleon warms up.

A Color Code

Mood changes a chameleon's color as well. A carpet chameleon changes color when it is in danger. A panther chameleon flashes from green to red and yellow when angry. The bright colors tell other chameleons it is ready to fight.

A male chameleon changes color when he courts a mate. He tries to be flashy. One kind of chameleon turns his body purple and light blue. He turns his eyelids yellow with green spots. Now, that's colorful.

Other Color Changers

Chameleons aren't the only color changers living in the wild. Many other animals have cells that help them change their looks. Changing color helps them survive.

The golden tortoise beetle, for instance, is bright gold. Yet it can change to a dull orange and brown, with dark spots. Then it looks like a ladybug. That's a smart move. Birds don't like the taste of ladybugs.

Spot the Changes

Some spiders can turn brown, gray, green, or yellow. These colors let the spider mix in with trees, stones, or leaves. Goldenrod spiders can turn yellow or white to blend with flowers. The spiders' prey cannot see these **predators** until it is too late.

Even some fish change color. A flounder is gray with spots. When a predator comes close, the fish becomes transparent. You can see through it, as if it weren't there.

By knowing an animal's color code, you can tell a lot about it. You know if it is hot or cold. You know if it is calm or angry. You also know if it is hiding or showing off. By watching for changes, you can become an expert in the language of color.

Some people are called chameleons. What does this mean?

BRIAN KENNEY

The goldenrod spider at the top is in hiding. The one below stands out.

Golden Moments

The golden tortoise beetle has tricks it can use to hide. Two of the tricks have to do with color.

© MARK MOFFETT/MINDEN PICTURES

The beetle has a special cover, shown here, that it can use to hide.

© JOHN T. FOWLER/ALAMY

The beetle can make spots appear. Then it looks like a ladybug. It can also turn yellow to hide among plants.

Wordwise

cell: building block of living things

melanin: chemical that darkens skin

pigment: chemical that makes a color

predator: animal that hunts others for food

species: kind of plant or animal

transparent: clear or see–through

SOCIAL STUDIES

Reading Strategy: After reading each section, think of the most important thing you learned.

Search for the Pirate Ship Whydah

By Patricia McGlashan

KENNETH GARRET

©DON MAITZ

GREGORY MANCHESS

The storm that sank the *Whydah* was a northeaster. That is a storm from the northeast.

Huge waves tossed the *Whydah*. It was the largest ship in a fleet of pirate ships. It was built to be fast and strong. Yet a killer storm in the Atlantic Ocean was hammering it. In the storm, the ship was hard to steer.

The crew did the best they could. But the waves battered the ship's sides. Wind and rain pounded the decks.

Suddenly, the mast broke. The ship rolled. Its deck ripped apart. The riches the ship carried sank into the sea.

The *Whydah* sank near Cape Cod, Massachusetts, with about 130 people aboard. Many were former slaves. Some were prisoners the pirates had captured.

Those who could swim tried swimming to shore. Land was close by, but the sea was rough. Only two people made it to shore and safety.

The ship sank to the bottom of the ocean that night in 1717. There, the wreck and treasure remained for nearly 300 years. Meanwhile, the ship and the storm lived on in sailors' stories.

Bringing Up the Past

Barry Clifford grew up on Cape Cod. He heard the stories about the *Whydah* and tales of its treasure. When he was old enough, he decided to search for the wreck.

Clifford began his search in libraries. He read history books and old ships' records. He studied old maps. Then he went to sea.

He and his crew looked along the coast. They had no luck during the first few years. Then, in 1985, they discovered a bell.

The bell had the name *Whydah* on it. That is how they knew they had found where the ship went down.

Clifford located the sunken ship in the water. The wreck did not hold chests of treasure. But there were riches of many kinds. They included things the pirates used in their everyday lives, such as plates, buttons, belt buckles, and shoes.

A Pirate's Life

Clifford has brought up more than 100,000 **artifacts** from the *Whydah*. Artifacts are objects made by humans. Some of his finds are worth lots of money. He has found jewelry and gold and silver coins.

Other artifacts from the ship tell us how pirates lived and worked. The ship carried weapons, for example. Clifford has found knives, swords, and even **hand grenades.**

It is clear that the pirates prized fancy **pistols.** They decorated them with ribbons. They had special tools for cleaning and polishing the guns.

Hammers, nails, and saws tell us the ship had a carpenter. He made repairs when the ship was damaged.

The artifacts help tell the whole story of the *Whydah*. It was not always a pirate ship. It started as something else.

NATIONAL GEOGRAPHIC MAPS

GREGORY MANCHESS

A sailor named Sam Bellamy became the pirate captain known as Black Sam (above). The map (left) shows where his last ship went down.

First a Slave Ship

The *Whydah* was built to be a slave ship. The vessel left London in 1715. It was loaded with goods such as guns, cloth, beads, and tools.

The crew sailed to the west coast of Africa. They traded the goods for enslaved Africans there.

The ship then sailed west to the Caribbean islands. There, the crew sold the Africans in the slave markets.

The islands had **plantations,** or large farms. Their owners grew sugar, tobacco, and coffee. They used enslaved Africans to do most work. They paid the workers nothing and treated them badly.

They paid the traders for the slaves, however. The traders got plenty of gold, silver, and crops. The crew loaded the *Whydah* with their riches. Then they set sail to return to England.

Captured by Pirates

The ship was not alone at sea: Pirates were watching it from a distance. Among them was Sam Bellamy. He was a pirate captain.

Bellamy was on the lookout for ships to steal. He was good at robbing and taking over vessels. He had earned a name for himself—Black Sam.

Black Sam spotted the *Whydah* in the Caribbean. It was just what he wanted. It was filled with riches, and the ship was fast and easy to sail.

He and his band of pirates chased the *Whydah* for three days. When they reached it, they jumped onboard. Black Sam and his crew had their swords and pistols ready. The traders gave up without a fight.

The pirates set the traders free. Black Sam turned the *Whydah* into a pirate ship. He added cannons for firepower. He used the ship to rob more than 50 other vessels.

Rich with his new loot, Black Sam headed north toward Cape Cod. Legend says he had a girlfriend there.

You know the rest of the story. The ship and its treasure went down in a storm. The riches were scattered over the ocean floor. They stayed there until Clifford found the ship 267 years later.

Still Searching

The *Whydah* had two lives before sinking. It was a slave ship and then a pirate ship. Now it has a third life. It helps us understand both pirates and slave traders.

The *Whydah* is the first pirate ship ever found in North America. Clifford is still searching for its artifacts. No one knows how much treasure is left at sea. No one knows what the treasures will tell us.

The waters Clifford searches are cold and rough. Some days he finds nothing. But as he says, it's not about the riches. It's about what the treasures have to teach us.

Wordwise

artifact: object made by humans

hand grenade: small bomb

pistol: small gun

plantation: large farm

▲ The ship's bell is made of bronze. That is a mix of metal that has tin and copper.

▲ Grenades like this one were the size of baseballs. They were filled with gunpowder.

▼ This fancy pistol, still loaded, was found at the *Whydah* wreck.

BILL CURTSINGER

BILL CURTSINGER

BILL CURTSINGER

◀ These coins were called pieces of eight.

Reading Strategy: Think of what you already know about snowboarding. Connect what you know with what you read.

SNOW MOTION

Use skill and science to become a champion.

By Jennifer Cutraro

Bright lights shine on the snowy mountain. Loud music plays. Excited people cheer. One of the world's best snowboarders is getting ready to hit the slopes. Her name is Gretchen Bleiler.

Bleiler is at the Winter X Games. She stands at the top of a mountain. She straps her snowboard onto her feet. She looks down the slope. She is ready to go.

Bleiler is an extreme snowboarder. She rides down snowy mountains and does tricks such as jumps and turns.

She competes on the halfpipe. It's a huge, U-shaped canyon dug out of the snow. The canyon is 122 meters (400 feet) long. Its walls are 7 meters (22 feet) high.

Bleiler leans forward, then races downward. She speeds back and forth between the walls. At the top of one wall, she flies into the air, spins, and lands. Then she zooms up the other side of the halfpipe. Again she flies up, spins, and lands.

Snowboarding is lots of fun, she says. Yet to be as good as she is takes lots of practice. To win, she must also understand the science of motion.

Law Number One

Three laws rule everything that moves—including snowboards. Sir Isaac Newton, a scientist, came up with the laws more than 300 years ago. They are called Newton's laws of motion.

To start a run, Bleiler uses Newton's first law of motion. This law is simple. You need a **force** to start moving. A force is a push or a pull on an object. You also need a force to stop moving.

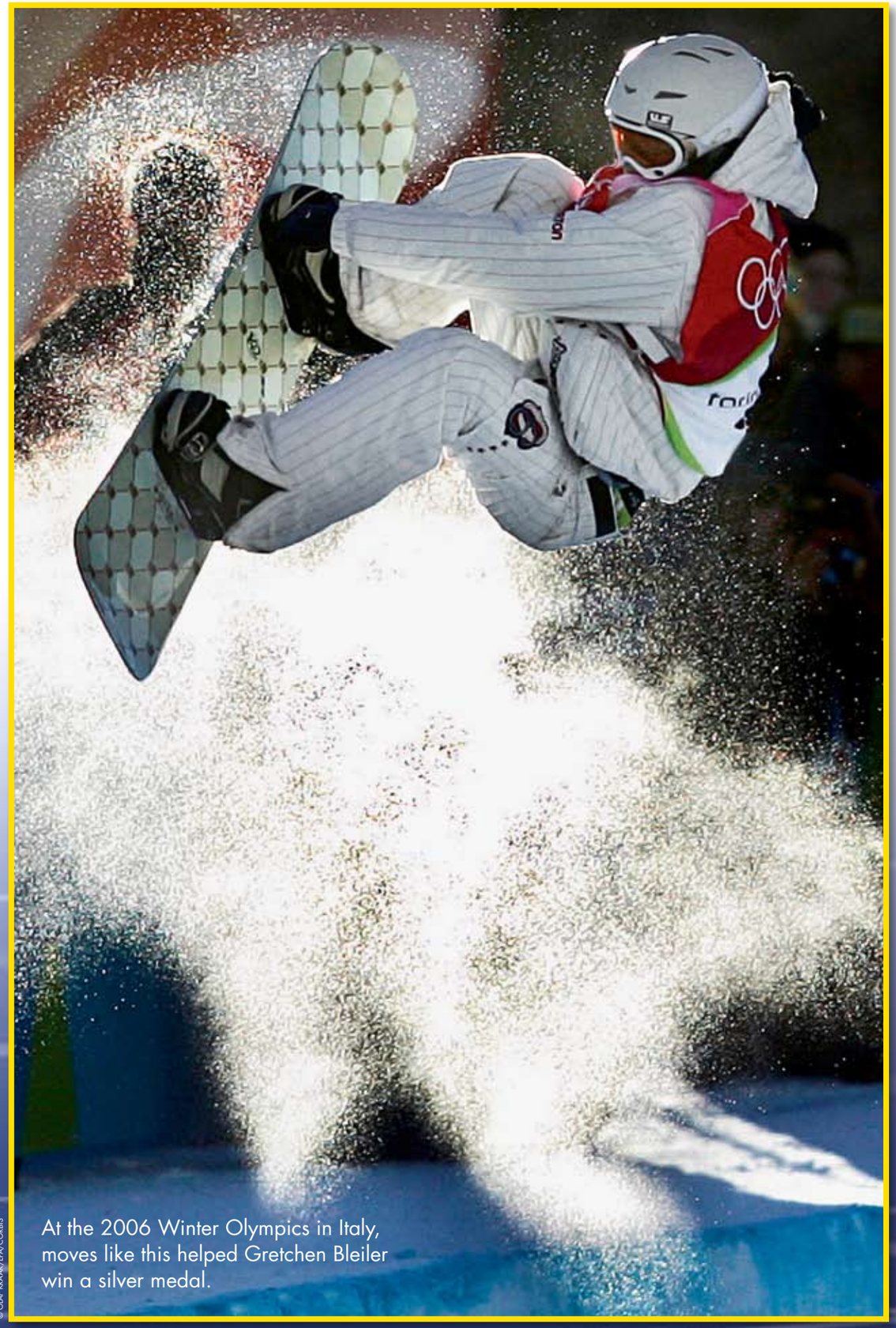
Without forces acting on them, objects remain as they are, either still or moving. Scientists call this **inertia.**

Bleiler overcomes inertia when she pushes her body forward. Then **gravity** takes over. Gravity is a force that pulls things toward the center of Earth. Gravity pulls snowboarders downhill. It helps Bleiler zoom down the slope.

laws: rules of the natural world

Gretchen Bleiler smiles after a race in Switzerland. Snowboards like hers are made like surfboards.

© JED JACOBSOHN/GETTY IMAGES [TOP]; © OLIVIER MAIRE/EPA/CORBIS [FACE]



At the 2006 Winter Olympics in Italy, moves like this helped Gretchen Bleiler win a silver medal.

© OLAF KRAAK/EPA/CORBIS

Law Number Two

Now Bleiler puts Newton's second law into action. It tells how much force is needed to move something. In this case, the something that needs to move is Bleiler. The amount of force she needs depends on her mass. That is her size.

Bleiler uses the second law to change direction. To move left and right, she leans in the direction she wants to turn. She puts the weight of her body over one side of her board. Moving her weight causes her board to change direction.

The whole time, she keeps her speed in mind. With the right amount of speed and careful movement of her weight, Bleiler can do great tricks and win.

Law Number Three

What about the snow? It may just stay on the ground, but it helps Bleiler do some amazing stunts.

As Bleiler's board pushes down on the snow, the snow pushes back up. This is Newton's third law in action. When an object pushes on something, it pushes back just as hard.

When she is at the top of a wall, the snow pushes up at her. In fact, it pushes up more than gravity pulls her down.

This law turns Bleiler into a high flier. By pushing down hard, she can fly into the air. She can fly 4 meters (12 feet) high. Then gravity takes over and pulls Bleiler back to the ground.

Free to Fly!

As Bleiler races downhill, something holds her back. It's the snow. It can slow her down. It can even stop her. That's because of **friction.** It is the way that objects slow down when they rub against each other.

As Bleiler's board rubs against the snow, friction slows her down. It also creates heat. To see how this works, you can do a simple experiment: Rub your hands together fast. What happens? Your hands get hot.

When a snowboard rubs against snow, it makes heat. That heat melts a bit of the snow. So the board glides over a thin layer of water. The water reduces friction. That helps Bleiler go fast.

All athletes need Newton's laws. They keep all athletes going. To snowboard or to shoot hoops, you need to put the laws of motion into action.

glides: slides

Wordwise

force: push or pull on an object

friction: the way that two things that rub together will slow each other down

gravity: force that pulls things toward the center of Earth

inertia: tendency of an object to remain as it is unless a force acts on it

Snowboard Science

In the photo above, Gretchen Bleiler competes in Colorado. Each time she races, she uses Newton's laws of motion to try to win. Look to the right to see how the science breaks down.

Water World

Acid may wipe out some of the smallest animals in Earth's oceans.

By Fran Downey

Just one scoop of seawater holds a world of tiny animals. Some look like jelly blobs or worms. These small creatures are facing big problems.

Reading Strategy: When you come across a word you do not know, look for clues in surrounding sentences.

LIFE SCIENCE

Layers of Life

Four oceans cover most of Earth. They are the Pacific Ocean, Atlantic Ocean, Indian Ocean, and Arctic Ocean. All four together are twice the size of dry land.

Water flows from one to the other. So they are like one ocean. Yet the ocean has many **habitats.** Habitats are places where plants and animals live. Colorful coral rises up near the Equator. In other areas, towering kelp forests grow. Everywhere you look, each layer of water has life.

The surface layer is warmed by the sun. Yet little light reaches below 200 meters (656 feet). Without sun, the water is cold. Some animals like the cold. Others gather around on the seafloor, where there are vents from underwater volcanoes. Heat from these holes warms the ocean floor.

Sharks and rays live near the surface. Whales and giant squid live in colder, deeper waters. Anglerfish live in some of the deepest layers. **Marine microfauna,** the smallest residents, are everywhere.

Filled With Food

Scientists have found 20,000 kinds of bacteria in just one liter (about a quart) of seawater. The bacteria have many friends their size. Some swim. Others float.

In the case of the blue button, different animals join forces. It may look like one animal, but many small animals make up the blue button. They work together to find food and protect each other.

Links in the Chain

All ocean animals are part of the ocean **food chain.** That's the order in which animals eat one another. The smaller the animal, the nearer it is to the bottom of the food chain.

Microfauna are dinner for many sea animals. A giant whale drinks in water filled with the creatures. Then it forces the water out its gills. The tiny life gets left behind—and eaten. Animals that eat this way are called **filter feeders.** Filters in their bodies trap microfauna.

Air Forces

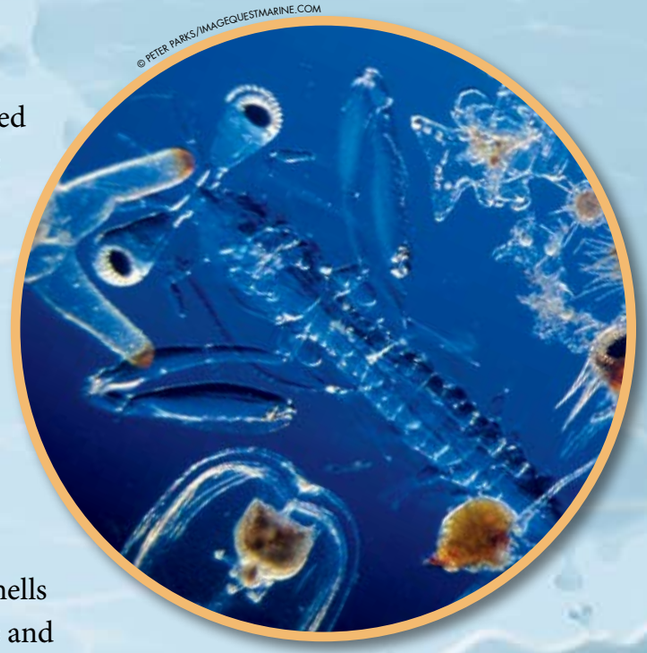
Even the smallest sea creatures are linked to life on land. Cars and factories make carbon dioxide gas that rises into the air. The gas acts like a blanket, trapping the sun's heat. This adds to global warming, a rise in average temperature.

The ocean soaks up millions of tons of carbon dioxide daily. This creates acid, which makes life hard for some sea creatures.

The creatures have trouble making shells and skeletons. If this goes on, sea snails and animals like them may die out. That means less food for the animals that eat them.

Everything on the planet is connected. A paper wrapper tossed on the ground could wind up in the water. Gas from car tailpipes and from smokestacks can go on to make acid in the ocean.

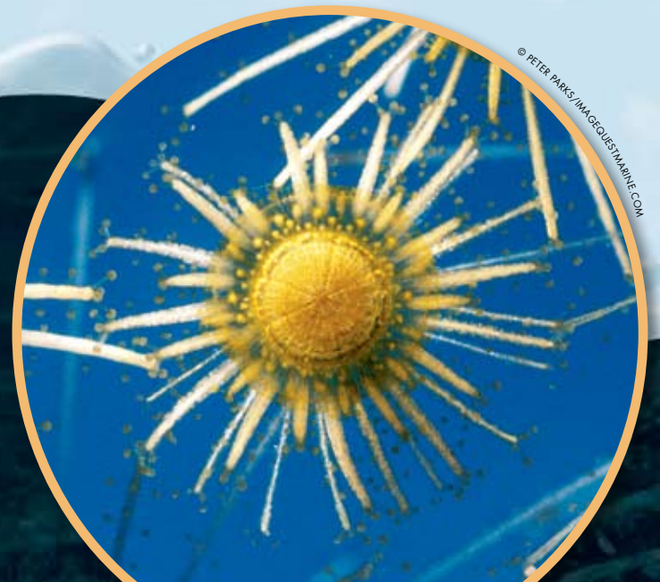
By studying these connections, we can learn how to protect all the water wonders that live in Earth's oceans.



Some marine microfauna eat plants. Others eat animals.

This type of tiny crab lives in every ocean except the Arctic Ocean.

This snail is about the size of a thumbnail.



Each of the arms on this blue button is a different animal.

Wordwise

food chain: order in which plants and animals eat one another

filter feeder: animal that filters food from seawater

habitat: place where a plant or an animal lives

marine microfauna: tiny sea creatures

© MARK NEWMAN/PHOTO NETWORK/ALAMY

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Cover: The laws of motion help a snowboarder race downhill.

(Photo © Ron Dahlquist/Superstock)

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